ESTIMATION OF PUREBRED AND CROSSBRED GENETIC VALUE IN THE HUNGARIAN PIG POPULATION

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Summary

Authors analyzed genetic trends and the stability of breeding values in Hungarian purebred breeds and their crosses concerning average daily gain and lean meat content. The analysis was based on the data collected by the National Institute for Agricultural Quality Control in field tests between 1997-2010. Genetic parameters of average daily gain and the lean meat percentage were estimated separately by REML method using the PEST and VCE6 softwares applying a two-trait animal model. Genetic trends for average daily gain in paternal breeds ranged between 0.10-1.96 g/year, in maternal breeds between 1.50-2.51 g/year. For lean meat percentage it ranged between -0.007-0.008 %/year and 0.01-0.033 %/year for all breeds, respectively. In order to calculate the breeding value's stability the maternal breeds were annually ranked for the analyzed traits on their purebred and crossbred breeding values, while because of the smaller datasets the paternal breeds were ranked only for the entire period. Stability of breeding values was characterized by the common representatives of the top 100 boars and 1000 sows based on the purebred and crossbred breeding values for every trait. Taking the top 100 and 1000 pigs based on the purebred and crossbred breeding values the difference of the breeding values using the crossbred breeding values of the same pigs refers to the superiority of using the crossbred breeding values in selection. Comparing the trends based on purebred breeding values with those based on crossbred breeding values, no significant differences were found except of HLW for average daily gain. The common number of highest ranked pigs as an indicator of stability of breeding values was low for the genotypes HLW and HL but higher for sire breeds for both traits. Calculating the differences between the crossbred breeding values of the ranked groups there was only difference in the average daily gain for the maternal breeds. As a conclusion negligible genetic change was found in lean meat percentage, the average daily gain was improved moderately.

Összefoglalás

Nagyné Kiszlinger H. – Farkas J. – Kövér Gy. – Nagy I.: A MAGYAR SERTÉS POPULÁCIÓ FAJTATISZTA ÉS KERESZTEZETT TENYÉSZÉRTÉKBECSLÉSE

A hazai fajtatiszta és keresztezett sertéspopulációkban vizsgálták az átlagos napi súlygyarapodás és a színhús százalék genetikai trendjeit és a tenyészértékek stabilitását az MgSzH által 1997 és 2010 között ÜSTV keretében gyűjtött adatok alapján. Az átlagos napi súlygyarapodás és a színhús százalék genetikai paramétereit külön becsülték a REML módszerrel a PEST és a VCE6 szoftver felhasználásával, kétváltozós egyedmodellt alkalmazva. Az átlagos napi súlygyarapodás esetében az apai fajtáknál 0,10-1,96 g/év, míg az anyai fajtáknál 1,50-2,51 g/év javulást becsültek. Színhús tekintetében az eredmények kedvezőtlenebbek voltak, -0,007-0,008 %/év ill. 0,01-0,033 %/év az apai illetve az anyai fajtáknál. A tenyészértékek stabilitásának kiszámításához a sertéseket fajtatiszta és keresztezett tenyészérték alapján évenként, az apai fajtákat tekintettel a kis elemszámra a teljes vizsgálati periódusra sorba rendezték. A tenyészérték stabilitást a fajtatiszta és a keresztezett tenyészérték alapján ragsorolt legjobb 100 kan és 1000 koca közös képviselőivel jellemezték mindkét tulajdonságban. A fajtatiszta és keresztezett tenyészérték alapján vett legjobb 100 és 1000 egyed keresztezett tenyészértékeinek különbsége utal a keresztezett tenyészérték fölényére a szelekció során. A fajtatiszta és a keresztezett tenyészérték alapján becsült genetikai trendek között nem találtak szignifikáns különbséget, kivéve a MNF fajtában az átlagos napi súlygyarapodás tulajdonságban. A tenyészérték stabilitására utaló közös egyedek száma a legjobb helyre rangsorolt állatok közül alacsony volt a MNF és a ML fajtákban, az apai fajtákban azonban magasabbnak bizonyult mindkét tulajdonságban. A rangsorba állított egyedek keresztezett tenyészértékei között csak az anyai fajtáknál találtak különbséget az átlagos napi gyarapodás tulajdonságra. Összességében megállapítható, hogy a színhús tekintetében a fejlődés elhanyagolható, és az átlagos napi súlygyarapodás is csak mérsékelten javult.

INTRODUCTION

Pig breeding is considered as an important sector in Hungarian animal breeding, and maintaining its competitiveness has high importance, thus the genetic potential of the Hungarian pig population has to be improved by selection continuously. Selection is based on data collected in field and station tests for various traits and the genetic merit for these traits is predicted by BLUP methodology. The BLUP procedure which is justified by its favourable mathematical properties (*Henderson*, 1975) is the most widely accepted method in animal breeding since the early 1990s. The characteristics of the different BLUP models are described in details by *Szőke* and *Komlósi* (2000). The Hungarian pig breeding sector has applied the BLUP procedure since the mid 1990s (*Groeneveld et al*., 1990) but the selection has only being using BLUP results since 2008 (*MgSzH*, 2009). As the BLUP method is predicting additive genetic merit this suggests that the most straightforward application is obtained in pure breeding. On the contrary crossing and hybridisation are widely used in pig breeding and breeding value prediction has to be done using data of purebred and crossbred pigs simultaneously. *McLaren et al*. (1985) suggest that basis of genetic value should be the performance of the crossbred offspring instead of the performance of the purebreds. Stamer *et al.* (2007) remind of inaccuracy as well by testing only the purebred pigs for selection. In the current Hungarian practice (MgSzH, 2009) breeding value prediction is conducted by the Agricultural Agency of Administration monthly using separately the data of the so called maternal (Hungarian Large White, Hungarian Landrace and their crosses) and paternal (Pieatrain, Duroc, Hampshire, and their crosses) genotypes including the breed codes in the applied BLUP model as fixed effect. Implicitly this approach considers that the genetic parameters of the various traits are the same for the different breeds evaluated together, which is not necessarily true. A possible solution of this contradiction is to treat a given trait of purebred and crossbred pigs as separate (correlated) traits. The rate of genetic change depends on the genetic correlation between purebred and crossbred performance (*Brandt* and *Täubert*, 1998). This approach doubles the number of traits to be evaluated, its use can only be suggested if the genetic correlation between the purebred and crossbred performances is lower than unity (<0.8). In this case purebred pigs will have two breeding values for every trait (the second is solely based on the performances of crossbred relatives) and the second breeding value could be the base of selection of the purebred pigs for crossing. After estimating the genetic parameters (*Kiszlinger et al*., 2011) using this technique, the first objective of this study was to determine the genetic trend of the Hungarian purebred and crossbred pigs for growth traits based on the purebred and crossbred performances separately. We also wanted to analyze the stability of breeding values defined as the common representatives of the top ranked animals based on breeding values according to the purebred and crossbred performances.

MATERIALS AND METHODS

The analysis was based on the data collected by the National Institute for Agricultural Quality Control (presently Agricultural Agency of Administration) in the course of field tests conducted between 1997 and 2010. The analyzed breeds were the Pietrain (Pi), Duroc (Du) and their reciprocal cross (Pi x Du), Hampshire (Ha) and its reciprocal cross with Pietrain (Pi x Ha), Hungarian Large White (HLW), Hungarian Landrace (HL) and their reciprocal cross (HLW x HL). The total numbers of animals in the pedigree file for (Pi- Pi x Du), (Pi- Pi x Ha), (HLW- HWL x HL) and (HL – HWL x HL) are 42004, 60926, 508009 and 393707, respectively.

In the field test ultrasonic (SONOMARK 100) fat depth data are collected from boars and gilts between 80 and 110 kg as follows: the 1st measurement point is between the 3rd and 4th lumbar vertebrae (8 cm laterally from the spinal cord), the 2nd measurement point is between the 3rd and 4th ribs (6 cm laterally from the spinal cord) and the loin muscle data are also taken at the 2nd measurement point. Using these measurements lean meat percentage, (LMP) can be calculated using the following equation (*MGSZH*, 2009):

lean meat percentage = 56.333381 - 0.122854 x f1 - 0,786312 x f2 +
+ 0,006160 x f2 x f2 + 0,237677 x l2

f1: fat depth (mm) between the 3rd and 4th lumbar vertebrae (mm);
f2: fat depth between the 3rd and 4th ribs (mm);
l2: loin muscle depth between the 3rd and 4th ribs (mm)

As the age of the animals is known and the body weights (with an accuracy of 1 kg) are recorded during the field tests, their average daily gain (ADG) is also calculated. The regulations of animal housing and feeding conditions are defined in the Hungarian Pig Performance Testing Code (*MGSZH*, 2009). Basic descriptive statistics were calculated applying SAS (SAS Institute Inc., 2004) (*Tables 4.* and *5*.). Testing for the significance of the breed effect was conducted using the GLM procedure of SAS (*SAS Institute Inc*., 2004). Genetic parameters of average daily gain and the lean meat percentage were estimated separately by REML method using the PEST (*Groeneveld*, 1990) (only for data coding) and VCE6 softwares (*Groeneveld et al*., 2008) applying a two-trait animal model. All crosses were split to 2 datasets (eg. Pi – Pi x Du; Du – Pi x Du). Average daily gain and lean meat percentage records of the purebred and crossbred pigs were considered as separate traits. Altogether 2-2 runs were performed for average daily gain and lean meat percentage. The structure of the animal model was the following:

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 & 0 \\ 0 & X_2 \end{bmatrix}\begin{bmatrix} b_1 \\ b_2 \end{bmatrix} + \begin{bmatrix} Z_1 & 0 \\ 0 & Z_2 \end{bmatrix}\begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + \begin{bmatrix} W_1 & 0 \\ 0 & W_2 \end{bmatrix}\begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}$$

where y_i = vector of observations for the i^{th} trait, b_i = vector of fixed effect for the i^{th} trait, a_i = vector of random animal effects for the i^{th} trait, c_i = vector of common litter effects for the i^{th} trait e_i= vector of residuals for the i^{th} trait and X_i, Z_i and W_i are incidence matrices relating records of the i^{th} trait to fixed effects, random animal effects and random common litter effects, respectively.

The variance-covariance matrices for the random additive genetic, random common litter and and residual effects were:

$$\mathrm{var[a]} = \mathrm{G} \otimes \mathrm{A}, \text{ with } \mathrm{G} = \begin{bmatrix} \sigma^2_{a1} & \sigma_{a12} \\ \sigma_{a21} & \sigma^2_{a2} \end{bmatrix}; \mathrm{var[c]} = \mathrm{W} \otimes \mathbf{I}, \text{ with } \mathrm{W} = \begin{bmatrix} \sigma^2_{a1} & \sigma_{a12} \\ \sigma_{a21} & \sigma^2_{a2} \end{bmatrix};$$

$$\mathrm{var[e]} = \mathrm{R} \otimes \mathrm{I}, \text{ with } \mathrm{R} = \begin{bmatrix} \sigma^2_{a1} & \sigma_{a12} \\ \sigma_{a21} & \sigma^2_{a2} \end{bmatrix}$$

where **A** is the numerator relationship matrix among the animals, **I** is and identity matrix, σ^2_{ai}, σ^2_{ci} and σ^2_{ei} are additive genetic, common litter and residual variances for trait *i*, σ_{aij}, σ_{cij} and σ_{eij} are are corresponding additive genetic, common litter and residual covariances between traits *i* and *j*.

In the model year-month, sex and herd effects were treated as fixed effects, while additive genetic and litter effects were considered as random effects (*Table 1.*).

Table 1.

The considered factors for the analyzed traits

Factor (1)	Type (2)	Lean meat (3)	Daily gain (4)
year-month (5)	Fix	x	x
Sex (6)	Fix	x	x
Herd (7)	Fix	x	x
Litter (8)	Random	x	x
Animal (9)	Random	x	x

1. táblázat. A modellben figyelembe vett hatások
faktor (1); típus (2); színhús százalék (3); átlagos napi súlygyarapodás (4); év-hó (5); ivar (6); telep (7); alom (8); egyed (9)

Genetic trends were estimated for average daily gain and lean meat content based on the annual means of breeding values of the analysed traits linearly regressed on the years of birth using SAS. Genetic trends of purebred pigs were calculated on the basis of their purebred and crossbred breeding values for every trait, while genetic trends of crossbred pigs were calculated only based on their crossbred breeding values. Comparison of purebred and crossbred genetic trends was done according to *Mead et al.* (1993).

Stability of the breeding values. The HLW and HL purebred pigs were annually ranked for average daily gain and lean meat percentage based on their purebred and crossbred breeding values, while because of the smaller datasets the purebred Pi, Du and Ha pigs were ranked only for the entire period. Stability of breeding values was characterized by the common representatives of the top 100 and 1000 pigs based on the purebred and crossbred breeding values for every trait. Taking the top 100 and 1000 pigs based on the purebred and crossbred breeding values the difference of the breeding values using the crossbred breeding values of the same pigs were also calculated.

Table 2.

Genetic covariances for average daily gain

Breed (1)	V_A	Cov_A	V_C	Cov_C	V_E
HLW (2) HLW x HL (3)	666 673	316	798 748	45	1260 1111
HL HLW x HL	559 681	228	880 747	48	1225 1107
Du Pi x Du	553 709	538	575 982	43	1115 1080
Ha Pi x Ha	1236 1297	718	762 861	47	1305 1264
Pi Pi x Ha	613 1324	679	1152 854	51	1051 1253
Pi Pi x Du	586 696	594	1157 978	72	1062 1086

2. táblázat. Genetikai kovarianciák az átlagos napi gyarapodásra
fajta (1); MNF (2); ML (3)

Table 3.

Genetic covariances for lean meat percentage

Breed (1)	V_A	Cov_A	V_C	Cov_C	V_E
HLW (2) HLW x HL (3)	0.63 0.61	0.28	0.47 0.31	0.02	1.15 0.75
HL HLW x HL	0.80 0.62	0.20	0.51 0.31	0.02	1.10 0.75
Du Pi x Du	0.32 0.30	0.17	0.33 0.41	0.02	1.42 1.46
Ha Pi x Ha	0.44 0.24	-0.12	0.36 0.12	0.01	1.13 0.82
Pi Pi x Ha	0.52 0.23	0.17	0.78 0.12	0.31	1.67 0.83
Pi Pi x Du	0.51 0.29	0.25	0.79 0.43	-0.58	1.68 1.48

3. táblázat. Genetikai kovarianciák a színhús százalékra
fajta (1); MNF (2); ML (3)

RESULTS

Genetic covariances for all breeds and traits are summarized in *Table 2.* and *Table 3*. Descriptive statistics of the examined traits for the paternal breeds and their crosses and their crosses are provided in *Table 4*. Significant differences

($p<0.0001$) were found between all genotypes in the trait lean meat percentage, while in daily gain no differences could be shown between Duroc and Hampshire pigs. The Pietrain pigs showed the highest LMP values which finding was in accordance with the literature (*Youssao et al*., 2002.; *Klimas and Klimiené*, 2009; *Geysen et al.,* 2000). On the contrary the ADG of the Pietrain pigs were lower than that of Hampshire and Duroc pigs. Similar results were reported by *Jasek et al.* (2006) although they found larger differences between the Hampshire and Duroc pigs to the advantage of the latter breed. *Wolf et al.* (2006) however, reported lower ADG for Hampshire compared to Pietrain pigs.

Table 4.

Descriptive statistics for paternal breeds

Trait (1)	Genotype (2) (n)	Minimum	Maximum	Mean	SD
Lean meat (%) (3)	Pi	52,7	68,0	61,7 a	2,1
Average daily gain (g) (4)	(5717)	283,0	774,0	526,6 a	60,5
Lean meat (%)	Du	50,0	66,8	58,2 b	1,9
Average daily gain (g)	(4868)	318,0	756,0	557,0 b	56,6
Lean meat (%)	Pi x Du	52,5	66,0	59,7 c	2,0
Average daily gain (g)	(4728)	317,0	764,0	566,0 c	67,9
Lean meat (%)	Ha	54,0	65,0	59,5 b	1,8
Average daily gain (g)	(1157)	361,0	809,0	560,1 b	80,6
Lean meat (%)	Pi x Ha	54,0	65,0	60,9 d	1,4
Average daily gain (g)	(8210)	346,0	846,0	576,3 d	65,7

4. táblázat. Az apai fajták leíró statisztikája

tulajdonság (1); genotípus (2); színhús százalék (3); átlagos napi súlygyarapodás (4)

Means with different characters are significant different ($p<5\%$)

A különböző betűkkel jelölt átlagok szignifikánsan eltérőek ($p<5\%$)

Table 5.

Descriptive statistics for maternal breeds

Trait (1)	Genotype (2)(n)	Minimum	Maximum	Mean	SD
Lean meat (%) (3)	HLW	50.0	67.5	57.3 a	1.9
Average daily gain (g) (4)	(232.755)	303.0	892.0	535.1 a	62.2
Lean meat (%)	HL	46.5	66.7	58.0 b	2.2
Average daily gain (g)	(100.321)	303.0	894.0	556.5 b	64.8
Lean meat (%)	HLW x HL	50.0	67.0	56.9 c	1.8
Average daily gain (g)	(223.899)	301.0	894.0	542.3 c	62.8

5. táblázat. Az anyai fajták leíró statisztikája

tulajdonság (1); genotípus (2); színhús százalék (3); átlagos napi súlygyarapodás (4)

Means with different characters are significant different ($p<5\%$)

A különböző betűkkel jelölt átlagok szignifikánsan eltérőek ($p<5\%$)

Descriptive statistics of the examined traits are provided in *Table 5*. for the Hungarian Large White, Hungarian Landrace and their cross. All genotypes showed similar means for all traits but the statistical analysis proved the significant differences ($p<0.0001$) in both traits between each genotypes and we found large SD values for average daily gains. It can be explained with the large number of herds (HLW: 120, HL: 64, HLW x HL: 130) suggesting a diverse raising environments.

The estimated genetic trend of average daily gain and lean meat content are presented in *Tables 6.* and *7*. The genotypic estimates ranged between 0.10 g/day g/day and 2.51 g/day for average daily gain and between –0.07 % and 0.033 % for lean meat percentage. Our estimates are unfavorable, however, it has to be noted that selection based on BLUP method (purebred breeding value) has been used for only three years so the genetic trends are likely to improve in the future.

Comparing the findings to the literature it can be stated that our estimates for genetic trends for average daily gain are partly substantially lower (Du, Ha, Pi x Ha for crossbred breeding value and Pi x Du crossbred breeding value) than those of other authors. *Tixier* and *Sellier* (1986) reported about values ranged between 1-4.7 g/day moreover *Hofer et al*. (1992), *Wolf et al.* (1998) and *da Costa et al.* (2001) estimated much higher gains, 6.5 and 10.3 g/day, 5.54 and 9.29 g/day, 2.75, 9.81 and 14.11 g/day, respectively. Contrary to these findings *Tribout et al.* (2010) established lower trends for daily gain for the whole period (1977-1998) of fattening (45 g ± 31), while *Csató et al.* (1994), *de Almeida Torres Filho et al.* (2005) and *Kasprzyk* (2007) showed slow progress of 0.93 g/day, 0.28 and 0.53 g/day and 0.39 g/day.

For lean meat percentage we observed that the yearly progress was very low in each genotype *Radnóczi et al.* (2009) showed statistically proven genetic progress for lean meat percentage in the breeds HLW , HL and their crosses between 2004-2009, but the progress was low (0,03 %) and its magnitude was very similar to our results. It has to be noted, however, that according to *Radnóczi et al.* (2009) during the period preceded by their analysis the lean meat percentage had been improved remarkably which would explain this lower result. *Tixier* and *Sellier* (1986) estimated in Large White and French Landrace pigs 0.15 and 0.42 % increase. *Wolf et al.* (1998) got similar values for Landrace and Large White pigs with 0.29 and 0.39 %, respectively, and also *Tribout et al.* (2010) observed 0.41 % increase per year. In connection with lean meat percentage it is worth noting that the trait showed very small additive genetic standard deviation which explains the negligible genetic progress. Thus the genetic trends of the analyzed traits could only be compared when they are expressed in additive genetic standard deviation units (%). Using these units, the values for average daily gain ranged for paternal breeds between 0,5-6,1 % while for maternal breeds between 5,8-9,7 %. For lean meat percentage the magnitude of the trends varied for paternal breeds between -1,07-3,2 % and for maternal breeds between 0,88-3,58 %. It can clearly be seen that the annual progress of the average daily gain is higher than that of the lean meat percentage (tables 6-7) but its superiority is somewhat less when it is expressed as the percentage of the additive genetic standard deviation. Using these units *Habier et al.* (2009) estimated for the Bavarian Pietrain population between 1985 and 2003 values 4 % and surprising high, 12 % for average daily gain and lean meat percentage, respectively.

Comparing the trends based on purebred breeding values with those based on crossbred breeding values, no significant differences were found except of HLW for average daily gain (*Table 6. and 7.*).

Table 6.

Estimated genetic trends of average daily gain and lean meat content of paternal breeds

	Average daily gain (3)		Lean meat content (4)	
Genotype	Purebred BV (1)	Crossbred BV (2)	Purebred BV	Crossbred BV
Pi	1.62a (0.11) s	1.96a (0.15) s _	0.001 (0.003) ns	0.005 (0.002) ns
Pi	1.38a (0.12) s	1.41a (0.13) s	-0.003 (0.004) ns	-0.001 (0.002) ns
Du	0.88a (0.11) s	0.93a (0.11) s	0.001 (0.003) ns	0.002 (0.002) ns
Ha	0.18 (0.42) ns	0.10 (0.56) ns	-0.007 (0.005) ns	0.021 (0.007) s
Pi x Ha		0.74 (0.38) ns		-0.003 (0.003) ns
		1.05 (0.39) s		-0.003 (0.004) ns
Pi x Du		0.79 (0.19) s		0.008 (0.004) ns
		1.06 (0.17) s		0.008 (0.004) ns

6. táblázat. Az átlagos napi súlygyarapodás és a színhús százalék genetikai trendje az apai fajtákban
fajtatiszta tenyészérték (1); keresztezett tenyészérték (2); átlagos napi súlygyarapodás (3); színhús százalék (4)
Means with different characters are significant different (p<5%)
A különböző betűkkel jelölt trendek szignifikánsan eltérőek (p<5%)

Table 7.

Estimated genetic trends of average daily gain and lean meat content of maternal breeds

	Average daily gain(3)		Lean meat content (4)	
Genotype	Purebred BV(1)	Crossbred BV (2)	Purebred BV	Crossbred BV
HLW	2.51a (0.20) s	1.50b (0.07) s	0.017 (0.006) s	0.007 (0.004) ns
HL	1.84a (0.23) s	1.75a (0.11) s	0.010 (0.007) ns	0.010 (0.002) s
HWL x HL		2.18 (0.13) s		0.028 (0.006) s
		2.07 (0.11) s		0.033 (0.006) s

7. táblázat: Az átlagos napi súlygyarapodás és a színhús százalék genetikai trendje az anyai fajtákban
fajtatiszta tenyészérték (1); keresztezett tenyészérték (2); átlagos napi súlygyarapodás (3); színhús százalék (4)
s =significant; ns = not significant
Means with different characters are significant different (p<5%)
A különböző betűkkel jelölt trendek szignifikánsan eltérőek (p<5%)

The common number of highest ranked pigs based on the purebred and crossbred breeding values was low and unbalanced for the genotypes HLW and HL (*Table 8.*) while viewing the paternal breeds it was substantially higher except of Hampshire boars where the stability of the breeding values for lean meat content was surprisingly low (*Table 9.),* especially for the top 100 rankings for lean meat

Table 8.

Common representatives of the top 100 and 1000 pigs in different years expressing the stability of the breeding values for average daily gain and lean meat content in maternal breeds (%)

	HLW (1)				HL (2)			
	Daily gain (3)		Lean meat (4)		Daily gain		Lean meat	
year	100♂	1000♀	100♂	1000♀	100♂	1000♀	100♂	1000♀
1997	71	90	64	94	39	90	54	90
1998	48	46	31	56	17	40	24	40
1999	35	45	44	60	41	37	30	25
2000	50	47	52	55	39	42	49	33
2001	41	43	41	52	27	41	46	45
2002	42	37	60	50	25	50	36	63
2003	45	43	58	56	33	50	27	58
2004	39	32	55	53	43	44	40	62
2005	27	35	63	41	45	40	45	50
2006	28	22	59	61	40	37	40	41
2007	46	33	54	58	37	58	43	54
2008	44	33	59	39	43	65	30	58
2009	32	31	65	46	36	52	55	72
2010	49	51	88	82	74	76	85	81

8. táblázat. Az átlagos napi súlygyarapodás és a színhús százalék tenyészértékeinek stabilitását jellemző közös egyedek a legjobb 100 és 1000 sertésből a különböző években anyai fajtákban (%)
MNF (1); ML (2); átlagos napi súlygyarapodás (3); színhús százalék (4)

percentage. According to our best understanding no similar references were available to compare our results. However, it is highly probably that for maternal breeds crossbred breeding values should be used when purebred pigs are selected for crossing both for average daily gain and for lean meat percentage. For paternal breeds this approach has lower importance because of the negligible difference between purebred and crossbred information.

Common representatives of the top 100 and 1000 pigs over the examined period expressing the

Pi (Pi-PixHa)				Pi (Pi-PixDu)				
Daily gain (1)		Lean meat (2)		Daily gain		Lean meat		
100♂	1000♀	100♂	1000♀	100♂	1000♀	100♂	1000♀	
83	88	69	83	93	97	81	88	

9. táblázat. Az átlagos napi súlygyarapodás és a színhús százalék tenyészértékeinek stabilitását jellemző
átlagos napi súlygyarapodás (1); színhús százalék (2)

Table 10.

Differences between the average crossbred breeding values of the top 100 and 1000 pigs in maternal breeds

	HLW (1)				HL (2)			
	Daily gain g/day(3)		Lean meat %(4)		Daily gain g/day		Lean meat %	
	♂	♀	♂	♀	♂	♀	♂	♀
1997	2.25	1.32	0.13	0.02	7.24	0.00	0.26	0.00
1998	6.18	5.31	0.34	0.14	13.49	7.58	0.36	0.29
1999	9.25	5.87	0.26	0.15	6.86	8.15	0.40	0.53
2000	6.17	6.96	0.21	0.19	11.80	7.94	0.36	0.56
2001	7.33	7.45	0.32	0.18	14.07	8.97	0.38	0.45
2002	6.84	7.10	0.14	0.15	15.42	7.43	0.34	0.25
2003	6.61	6.81	0.12	0.13	12.45	6.51	0.38	0.16
2004	9.83	9.73	0.14	0.18	11.21	7.75	0.37	0.11
2005	11.88	10.26	0.11	0.31	10.19	7.12	0.34	0.20
2006	16.10	13.10	0.15	0.15	12.20	7.67	0.26	0.24
2007	12.44	10.51	0.16	0.16	12.00	6.86	0.29	0.25
2008	9.59	8.95	0.13	0.27	12.10	6.67	0.48	0.22
2009	13.31	12.63	0.12	0.26	10.02	6.60	0.22	0.10
2010	9.51	7.89	0.02	0.05	3.37	3.68	0.05	0.09

10. táblázat. A legjobb 100 és 1000 egyed átlagos tenyészértékei közti különbsége az anyai fajtákban
MNF (1); ML (2); átlagos napi súlygyarapodás (3); színhús százalék (4)

Comparing the differences between the crossbred breeding values of both ranked groups it can be seen that for average daily gain the differences are substantial for the HLW and HL genotypes (*Table 10.*) but in the sire breeds no differences were found (*Table 11.*). Thus the crossbred breeding value includes more information than the purebred one in the maternal genotypes, which should be exploited. It must be noted that the database for sire breeds was substantially smaller and can explain our findings. In the breeding values of lean meat content we observed negligible differences for all genotypes which was probably because of the low variability of this trait. This low differences suggest the usage of purebred breeding values in selection for crossbred breeding.

Table 9.

stability of the breeding values for average daily gain and lean meat content in sire breeds (%)

	Du				Ha			
	Daily gain		Lean meat		Daily gain		Lean meat	
	100♂	1000♀	100♂	1000♀	100♂	1000♀	100♂	1000♀
	85	93	68	91	78	82	5	82

közös egyedek a legjobb 100 és 1000 sertésből a vizsgálat teljes időtartamában apai fajtákban (%)

Table 11.

Differences between the average crossbred breeding values of the top 100 and 1000 pigs in sire breeds

	Pi (Pi-PixHa)				Pi (Pi-PixDu)				Du				Ha			
	Daily gain g/ day(1)		Lean meat(2)		Daily gain		Lean meat		Daily gain		Lean meat		Daily gain		Lean meat	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1997	0.00	0.00	0.03	0.03	0.00	0.04	0.01	0.00	0.00	0.11	0.02	0.11	-	0.00	-	0.00
1998	0.00	3.21	0.00	0.17	0.00	0.00	0.01	0.01	0.00	0.04	0.07	0.01	0.00	5.05	0.36	0.52
1999	0.00	0.28	0.12	0.07	0.00	0.1	0.03	0.03	0.00	0.41	0.00	0.04	0.00	0.81	0.33	0.48
2000	0.00	1.25	0.03	0.01	0.00	0.38	0.06	0.02	0.00	0.01	0.02	0.05	0.00	3.43	0.77	1.09
2001	0.00	1.34	0.04	0.03	0.00	0.34	0.00	0.01	0.00	0.51	0.04	0.04	0.00	5.66	0.48	0.64
2002	0.00	4.21	0.01	0.01	0.00	0.55	0.01	0.01	0.00	0.38	0.00	0.01	0.00	1.84	0.22	0.64
2003	0.00	0.78	0.05	0.02	0.00	0.02	0.01	0.00	0.00	0.25	0.05	0.02	0.00	3.71	0.24	0.39
2004	0.00	0.4	0.05	0.04	0.00	0.00	0.02	0.01	0.00	0.00	0.03	0.03	0.00	0.36	0.26	0.41
2005	0.00	1.6	0.04	0.10	0.00	0.48	0.03	0.03	0.00	0.15	0.04	0.02	0.00	3.32	0.19	0.54
2006	0.00	6.53	0.09	0.11	0.00	0.34	0.02	0.02	0.00	1.06	0.03	0.01	0.00	2.78	0.24	0.34
2007	0.00	0.37	0.05	0.05	0.00	0.00	0.01	0.00	0.00	0.20	0.01	0.02	0.00	0.00	0.00	0.00
2008	0.00	0.23	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.41	0.01	0.02	0.00	0.00	0.00	0.00
2009	0.00	1.23	0.07	0.03	0.00	0.00	0.02	0.07	0.00	0.00	0.05	0.02	0.00	0.79	0.10	0.31
2010	0.00	0.00	0.03	0.03	0.00	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00

11. táblázat. A legjobb 100 és 1000 egyed átlagos tenyészértékei közti különbsége az apai fajtákban
átlagos napi súlygyarapodás (1); színhús százalék (2)

CONCLUSIONS

The breeding work showed negligible genetic change in the trait lean meat content which agrees to our expectations because the variability in this trait in the analyzed herds was low. The average daily gain was improved slightly but as the BLUP based selection has only been used for 3 years, increased genetic trends can be expected in the future. Based on the results of stability of breeding values it would be useful for crossbreeding to take the crossbred breeding values as the basis of selection of purebred pigs at least for average daily gain. Since the superiority in performance of the crossbred progeny of which parents were selected on crossbred breeding value – instead of on purebred breeding value – can easily be calculated, it would be useful to apply this method in order to achieve as remarkable validity as possible on the production level.

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